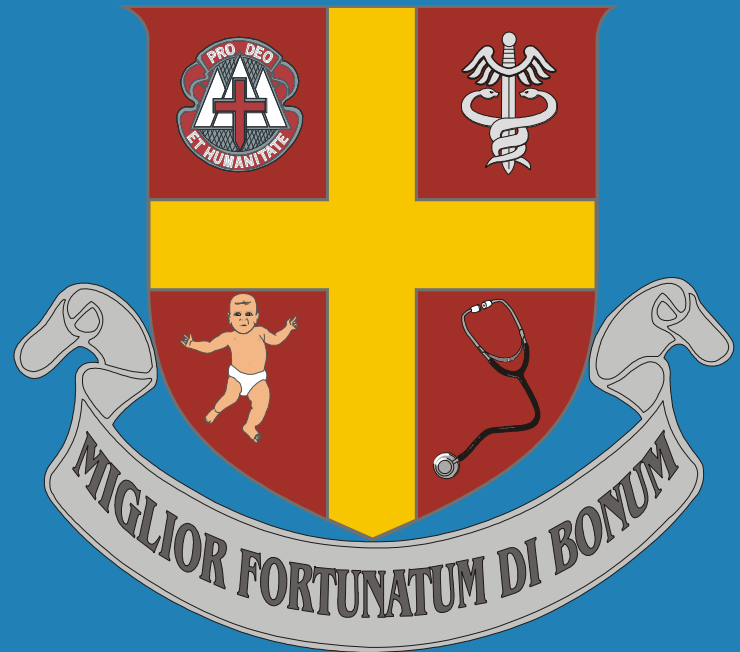


Infant Nutrition I - Breastfeeding

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Infant Nutrition

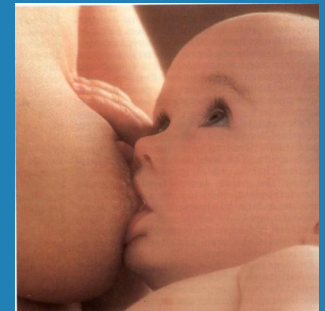
Objectives

- ⦿ **Recognize the benefits of breastfeeding**
- ▮ **Have a strategy to optimize breastfeeding**
- ▮ **Identify factors that might prevent successful breastfeeding**
- ▮ **Understand potential nutritional inadequacies of breast milk in older infants**
- ▮ **Know whether or not medications can be taken by breastfeeding mothers**

Infant Nutrition

Breastfeeding

“Breast is Best”



The American Academy of Pediatrics (AAP) has recommended exclusive breastfeeding during the first 6 months of life and continuation of breastfeeding for the second 6 months as optimum nutrition in infancy

Infant Nutrition

Breastfeeding

- ☼ Human milk is the optimum nutrient for term and near-term infants with respect to protein, fat, and carbohydrate composition
- ▮ The anti-infective properties of human milk reduce the incidence of acute illnesses
 - Diarrhea
 - UTI
 - Lower respiratory infection
 - Otitis Media



Infant Nutrition

Breastfeeding

- ☼ It is suggested that the incidence of immune-mediated diseases such as diabetes mellitus, Crohn disease, eczema, asthma, and allergic gastroenteritis is lower among breastfed infants
- ▮ Psychological and long-term cognitive advantages have been observed in breastfed infants compared with formula-fed infants



Infant Nutrition

Breastfeeding

Composition of Human Milk - Protein

- ☼ **Whey-dominant (cow milk is casein-dominant)**
- ▮ **Whey proteins are digested more easily, which promotes gastric emptying**
- ▮ **Amino acid content is human-specific**

Infant Nutrition

Breastfeeding

Composition of Human Milk - Lipids

- ☼ **Lipids provide approximately 50% of the caloric content of human milk**
- ▮ **Lipids are contained in milk fat globules, absorption and digestion are ideal**
- ▮ **Contains fatty acids not found in cow milk**

Infant Nutrition

Breastfeeding

Composition of Human Milk - Carbohydrates

- ☼ **Lactose is the major carbohydrate in human milk**
- ▮ **Hydrolyzed in the small intestine into glucose and galactose by lactase**

Infant Nutrition

Breastfeeding

Composition of Human Milk - Carbohydrates

- ⦿ **Some lactose enters the distal small bowel where it ferments, permitting proliferation of predominantly acidophilic bacterial flora (lactobacilli)**
- ▮ **An acid medium suppresses growth of pathogenic organisms and promotes absorption of calcium and phosphorus**

Infant Nutrition

Breastfeeding

Composition of Human Milk - Immunity

- ☼ **Lactoferrin, lysozyme, and secretory immunoglobulin A are specific whey proteins involved in host defense**
- ▮ **Oligosaccharides, nucleotides, growth factors, and cellular components of human milk also enhance the infant's immune system**

Infant Nutrition

Breastfeeding

Composition of Human Milk - Immunity

- ☼ **The mother may produce specific antibodies that are excreted in her milk as secretory immunoglobulin A (IgA)**
- ▮ **Specific passive immunity is enhanced in this system**

Infant Nutrition

Breastfeeding

- ☼ Human milk also contains minerals, vitamins, and micronutrients in concentrations sufficient to achieve optimum growth in the term and near-term infant
- ▮ No supplementation is required until 4 to 6 months of age when iron (approximately 1 mg/kg per day) should be added to the diet, preferably in the form of iron-fortified cereal

Infant Nutrition

Breastfeeding

- ☼ **Vitamin D supplementation also may be necessary in term infants at approximately 4 to 6 months of age if they are dark-skinned or exposed to low levels of sunlight**
- ▮ **Fluoride supplementation is recommended from 6 months to 3 years of age in breastfed and formula-fed infants if the water supply contains less than 0.3 ppm fluoride**

Infant Nutrition

Breastfeeding

Keys to Successful Breastfeeding

- ❁ **Discuss feeding plans with mother prior to delivery**
- ▮ **Education about the details of breastfeeding during prenatal classes**
- ▮ **Instruction and discussion should continue during hospitalization and thereafter**

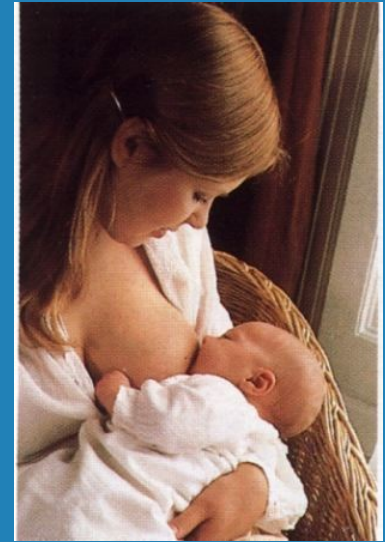


Infant Nutrition

Breastfeeding

Keys to Successful Breastfeeding

- ⦿ **Breasts should be examined prenatally to identify potential problems (eg. inverted nipples)**
- ▮ **Breastfeeding should begin as soon as possible after delivery**
- ▮ **Infants should room-in with their mothers and be encouraged to breastfeed at least 8 to 12 times per day**

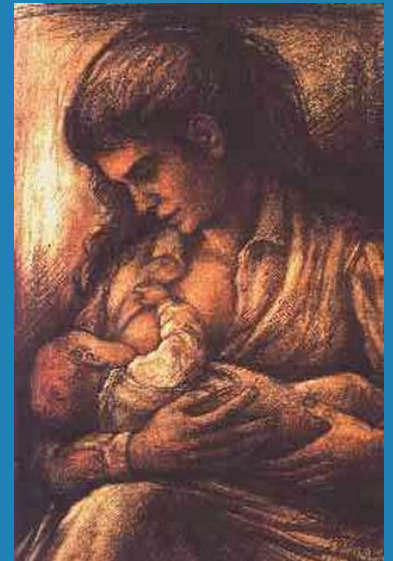


Infant Nutrition

Breastfeeding

Keys to Successful Breastfeeding

- ❁ Supplementary feedings of water, glucose water, or formula are not necessary for healthy infants and may be counterproductive
- ▮ If the breastfeeding is incomplete or ineffective, the mother should initiate a regimen of expressing her milk



Infant Nutrition

Breastfeeding

"Accept it, without the advances of medical technology it would be impossible for you to breastfeed your baby!"



Infant Nutrition

Breastfeeding

Problems with lactation

- ⦿ **Early hospital discharge (<48 h) and prematurity constitute risk factors for lactation failure**
- ▮ **These infants must be examined within 2 days of hospital discharge to assess breastfeeding and initiate appropriate intervention strategies as necessary**

Infant Nutrition

Breastfeeding

Problems with lactation

⊗ Sleepy babies

- **Baby falls asleep while feeding on first side**
- **Will not awaken to feed on second breast**
- **Leaving milk in second breast sends message to pituitary that more-than-enough milk is being produced**

▮ Solution

- **Limit feeding on first breast to 5 to 7 minutes**
- **Feed on second side until baby falls asleep**

Infant Nutrition

Breastfeeding

Problems with lactation - Jaundice

- ⦿ **Excessive jaundice is the result of inadequate human milk intake during the first week of life, necessitating increased frequency of breastfeeding**
- ▮ **Associated with decreased intake and increased enteropathic circulation, occurs predominantly during the first week of life**

Infant Nutrition

Breastfeeding

Problems with lactation - Jaundice

- ▮ **Bilirubin levels in breastfed infants may peak normally at 16 to 18 mg/dL**
- ▮ **Such levels do not require phototherapy unless there are other associated conditions (eg, hemolysis, metabolic errors, infection)**
- ⊗ **Discontinuation of breastfeeding is rarely justified**

Infant Nutrition

Breastfeeding

Storage of Breast Milk

- ⦿ **Expressed human milk that will be fed within 48 hours of collection can be refrigerated**
- ▮ **If not fed within 48 hours should be frozen**
- ▮ **Milk expressions should be packaged and frozen separately and labeled with the name and date if the infant is to be cared for in a child care center**
- ▮ **Frozen milk should be thawed in warm water**
- ▮ **Microwave warming should be avoided**

Infant Nutrition

Breastfeeding



Infant Nutrition

Breastfeeding

Breast-feeding and medication

- ☼ **Most medications are safe for nursing mothers**
- ▮ **Generally, medication should be taken only when needed and in moderation**
- ▮ **Even mothers who must take daily medication for conditions such as epilepsy, diabetes, or high blood pressure can usually breast-feed**

Infant Nutrition

Breastfeeding

- ⦿ **acetaminophen**
- ▮ **most antibiotics**
- ▮ **most antiepileptics**
- ▮ **antihistamines**
- ▮ **alcohol in moderation (large amounts of alcohol can cause drowsiness, weakness, and abnormal weight gain in an infant)**
- ▮ **most antihypertensives**
- ▮ **aspirin (should be used with caution)**
- ▮ **caffeine (moderate amounts in drinks or food)**
- ▮ **codeine**
- ▮ **decongestants**
- ▮ **ibuprofen**
- ▮ **insulin**
- ▮ **quinine**
- ▮ **thyroid medications**

Infant Nutrition

Breastfeeding

Drugs contraindicated while breastfeeding

- ⦿ **Radioactive drugs used for some diagnostic tests like Gallium-69, Iodine-125, Iodine-131, or Technetium-99m - can be taken if the woman stops nursing temporarily**
- ▮ **Bromocriptine (Parlodel)**
- ▮ **Antimetabolites (chemotherapy drugs) - kill cells in the mother's body, they may harm the baby as well**
- ▮ **Ergotamine (for migraine headaches) - causes vomiting, diarrhea, convulsions in infants**

Infant Nutrition

Breastfeeding

Drugs contraindicated while breastfeeding (cont.)

☼ **Lithium**

▮ **Methotrexate**

▮ **Drugs of Abuse**

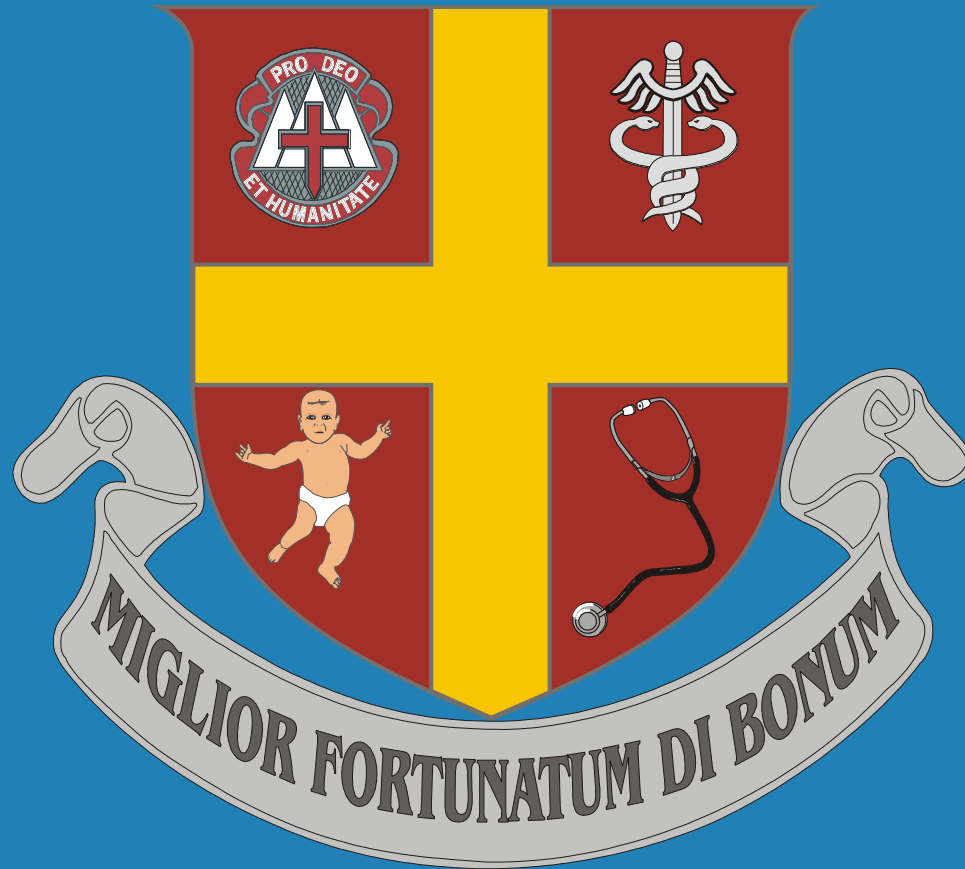
- **Some drugs, such as cocaine and PCP, can intoxicate the baby**
- **Others, such as amphetamines, heroin and marijuana, can cause a variety of symptoms, including irritability, poor sleeping patterns, tremors, and vomiting**

Infant Nutrition

Summary

- ⊗ **Breast is best**
 - ▮ **Successful breastfeeding requires planning, education, and encouragement**
 - ▮ **Common problems interfere with success**
 - ▮ **Breast milk may have inadequate amounts of some nutrients for older infants**
 - **Solid foods introduced by 4 to 6 months will meet most of those needs**
 - ▮ **Most medications can be taken by breastfeeding mothers**

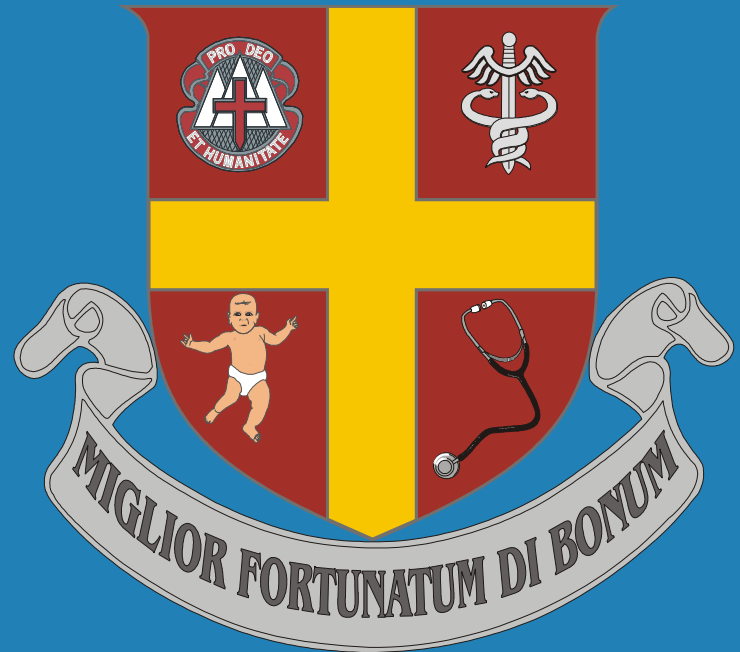
Questions?



Infant Nutrition II - Formulas and Solids

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Infant Nutrition

Objectives

- ⦿ **Delineate the optimum nutrition for infants through the first year of life**
- ▮ **Describe the formulas that can be used as adequate substitutes for term infants whose mothers cannot or choose not to breastfeed**
- ▮ **Understand the application of formula changes in correcting specific feeding problems**
- ▮ **Explain the place of low-iron-containing formulas in infant feeding**
- ▮ **Explain the implications of adding solid foods to the diets of breastfed and formula-fed infants**

Infant Nutrition

Formula Feeding

- ❁ **Cow milk formulas and soy milk formulas are adequate substitutes for term and near-term infants who are not breastfeeding during the first 12 months of life**
- ❁ **All of the infant's nutritional needs may be met with iron-fortified formulas fed during the first 4 to 6 months, and these formulas provide a major source of nutrition for the second 6 months of life**



Infant Nutrition

Formula Feeding

Indications for the use of infant formulas are:

- 1. As substitute or supplement feedings for mothers who do not or cannot provide human milk for their infants**
- 2. Infants who have certain inborn errors of metabolism or other conditions causing intolerance to human milk (eg, galactosemia and tyrosinemia)**

Infant Nutrition

Formula Feeding

Indications for the use of infant formulas are:

- 3. Infants whose mothers have certain infections caused by organisms known to be transmitted in human milk (eg, human immunodeficiency virus and, under rare circumstances, cytomegalovirus, herpes simplex virus, and bacteria)**



Infant Nutrition

Formula Feeding

Indications for the use of infant formulas are:

- 4. Infants whose mothers are undergoing cancer chemotherapy or are receiving certain other drugs, foods, medications, or environmental agents that are excreted into human milk**
- 5. Consider if the infant fails to gain weight following optimal encouragement and therapy for breastfeeding**

Infant Nutrition

Formula Feeding

Composition of Formulas

- ☼ **Protein in cow milk formula is approximately 40% greater than that in human milk**
- ▮ **Bovine whey-dominant formulas produce amino acid patterns that differ from those seen with human milk whey protein**

Infant Nutrition

Formula Feeding

Composition of Formulas

- ⦿ **The fat content of cow milk formulas constitutes approximately 50% of their energy**
- ▮ **The butterfat of cow milk formula is replaced largely with vegetable oils that enhance digestibility and absorption**
- ▮ **The essential fatty acids, linoleic and alpha-linolenic acids, are supplemented to provide adequate substrate**

Infant Nutrition

Formula Feeding

Composition of Formulas

- ⦿ **Lactose is the major carbohydrate in standard cow milk-based formulas**
- ▮ **Lactose intolerance is uncommon in the first year of life**
 - **there is a growing market for lactose-free formulas for infants who have nonspecific symptoms of bloating, gas, spit-up, and diarrhea**
- ▮ **With the exception of galactosemia and secondary lactase deficiency (usually after gastroenteritis), there are no reasons for lactose-free formulas**

Infant Nutrition

Formula Feeding

Composition of Formulas

- ⦿ Iron is an important component of cow milk formulas and is present in a concentration of 12 mg/L
- ▮ Low-iron-containing formulas continue to be marketed because of a perception that iron causes constipation and other feeding problems
- ▮ **Data DO NOT support this perception**
- ▮ Cow milk formula-fed infants **must** receive iron-fortified formula

Infant Nutrition

Formula Feeding

Composition of Formulas

- ❁ **Fluoride should be added after 6 months of age if the fluoride concentration in the water supply is less than 0.3 ppm**

Infant Nutrition

Formula Feeding

Formula intake

- ▮ **Formula intake should be adequate to support weight gains of approximately 1 ounce per day for the first 3 months, $\frac{1}{2}$ to $\frac{3}{4}$ ounce per day for the second 3 months, and $\frac{1}{4}$ to $\frac{1}{2}$ ounce per day between 6 and 12 months of age**
- ▮ **Formula intake generally ranges from 120 to 180 ml / kg per day in the first 3 months and remains at 26 to 32 oz / d thereafter through the first year of life**

Infant Nutrition

Formula Feeding

Formula intake

- ▮ **Solid feedings provide additional caloric intake for formula-fed infants after 4 to 6 months of age and result in greater weight gains than in breastfed infants**
 - **Breastfed infants decrease their intake of human milk when introduced to solid foods**
 - **Formula-fed infants generally continue to consume the same volume of milk in spite of additional caloric intake from solids and have accentuated weight gain velocity**

Infant Nutrition

Formula Feeding

Mixing Formula

- ☼ **Most municipal water supplies are safe, and boiling water is unnecessary**
- ▮ **Families using well water or pond water or who live in areas where flooding is a problem should boil their water**
- ▮ **The proper ratio of concentrate to water must be maintained to avoid hypernatremic dehydration or hyponatremic overhydration**

Infant Nutrition

Formula Feeding

Mixing Formula

- ⦿ **Infants can be exposed to lead if contaminated tap water is used to prepare their formula**
- ▮ **Older homes may contain lead pipes, and some newer homes are at risk because the pipes may have been soldered with lead**
- ▮ **To reduce risk of lead contamination in tap water, mothers should be instructed to use only cold water, run the water for 2 minutes, and avoid boiling water, which can increase the concentration of lead**

Infant Nutrition

Formula “Problems”

- ❁ **Soy formulas and lactose-free cow milk formulas support the growth of normal term infants through the first year of life**
- ▮ **Use of these formulas reportedly comprises nearly 25% of the formula market, although this far exceeds the estimated incidence of cow milk protein and lactose intolerance for which they are employed**

Infant Nutrition

Formula “Problems”

Problems often attributed to formula

- ☼ **Reflux (“spitting-up”)**
 - Anatomical, not formula-related
 - **MAY be helped with Enfamil AR**
 - Rice protein increases viscosity making formula thicker
 - **MAY be helped with elemental formula (Nutramigen, Alimentum)**
 - More digestible, thus faster gastric emptying



Infant Nutrition

Formula “Problems”

Problems often attributed to formula

☼ Gas, colic

- Rarely due to lactose
- **MAY** respond to lactose-free formula
 - Soy or lactose-free
- **Only demonstrated benefit is from elemental formula**
 - Probably a mild form of “milk-protein enteropathy”



Infant Nutrition

Formula “Problems”

Problems often attributed to formula

⊗ Constipation

- Defined as **hard stool** (not infrequent stool)
 - Consider “dyssynergy”
- Usually blamed on iron
 - No place for “low-iron” formula - **never use it!**
- More common with soy formula

Infant Nutrition

Special Infant Formulas

Soy formula

- ☼ **Infants who have IgE-mediated cow milk protein intolerance may benefit from soy formula**
 - **Milk allergy is rare, and up to 20% also manifest soy allergy**
 - **Elemental formula may be a better choice**
- ☼ **Rarely needed**

Infant Nutrition

Special Infant Formulas

Lactose-free formula

- ☼ **Lactose-free cow milk formulas are popular for infants who are perceived to have “lactose intolerance”**
 - **This exuberance is not justified by true incidence of lactose intolerance**
- ▮ **May be useful in differentiating lactose intolerance from cow-milk protein intolerance**

Infant Nutrition

Special Infant Formulas

Elemental formula (Nutramigen, Alimentum)

- ☼ **Protein hydrolysate formulas are more appropriate for the infant who is intolerant to intact milk protein**
- ▮ **Most protein hydrolysate formulas also are free of lactose**
 - **This may facilitate the efficacy of these formulas in patients who have chronic malabsorption**



Infant Nutrition

Feeding Solids

- ▮ **The ability to digest and absorb proteins, fats, and carbohydrates is sufficiently mature by 4 to 6 months of age to tolerate cereal, puréed fruits, vegetables, and meats**
- ▮ **Infants typically begin to indicate readiness for oral feedings by opening their mouths and leaning forward in the sitting position**

Infant Nutrition

Feeding Solids

- ☼ **By 4 to 6 months infants can indicate satiety or lack of readiness by turning away**
- ▮ **Mothers should follow these cues to avoid overfeeding or creating conflict over oral feeding**

Infant Nutrition

Feeding Solids

- ⦿ **Introducing solids prior to 4 to 6 months of age is inappropriate**
- ▮ **There is no scientific evidence to support the claim that solids (cereal in the bottle) will help an infant sleep longer at night**
- ▮ **It is important to continue breastfeeding or formula feeding through the first year of life**

Infant Nutrition

Feeding Solids

Introducing Solids

- ⦿ **Single-ingredient foods generally should be introduced first, with no more than one started at weekly intervals to permit identification of any intolerance**
- ▮ **Infant cereals are a good first choice**
- ▮ **The introduction of puréed fruits, vegetables, and meats may be guided by individual taste and preference**

Infant Nutrition

Feeding Solids

- ⦿ **Finely chopped foods may be introduced at 10 to 12 months of age, but parents must be watchful for potential aspiration of food particles**
- ▮ **Peanuts, raw fruit, popcorn, and hotdogs should not be fed to children younger than 2 years of age**

Infant Nutrition

Juice

- ⦿ Juices may be introduced when the infant can drink from a cup, but they should not replace milk or formula
- ⦿ These products are high in carbohydrates and may decrease consumption of protein-containing liquids if given excessively
- ▮ Quantities greater than 8 oz / day may result in diarrhea and have the potential for producing caries if infants are exposed to them for sustained periods throughout the day from a bottle

Infant Nutrition

Water

- ❁ **Extra water generally need not be consumed except in instances of excessive losses, such as diarrhea or excessive perspiration.**

Infant Nutrition

Summary

⊗ Breast is best

- A standard cow-milk formula usually provides an adequate substitute

▮ Formula changes may correct some feeding problems

- Changes must be properly directed
- Avoid inappropriately blaming lactose, iron, etc.

▮ There is **no place** for low-iron-containing formulas in infant feeding

▮ Solid foods should be added to the diets of breastfed and formula-fed infants beginning at 4 to 6 months

- Provides for additional iron needs
- Earlier introduction of solids is not warranted or recommended

Questions?

